Published in final edited form as:

J Psychiatr Res. 2017 January ; 84: 105–112. doi:10.1016/j.jpsychires.2016.09.031.

Adolescent self-injurers: Comparing non-ideators, suicide ideators, and suicide attempters

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Abstract

Adolescent non-suicidal self-injury (NSSI) and suicidality are serious health concerns; however, factors that contribute to the transition from NSSI to suicide ideation and suicide attempts are unclear. To address this gap, we investigated whether demographic characteristics, child maltreatment, and psychiatric factors are associated with the level suicidality among adolescents with a history of self-injury. Participants were three groups of adolescent inpatient self-injurers ($n = 397$, 317 female), aged 13–18 years ($M = 15.44$, $SD = 1.36$): (a) non-ideators ($n = 96$; no current suicide ideation and no lifetime suicide attempts), (b) suicide ideators ($n = 149$; current ideation and no lifetime attempts), and (c) suicide attempters ($n = 152$; current ideation and at least one lifetime attempt). Participants completed interviews assessing psychiatric diagnoses, suicidality, and NSSI characteristics, as well as questionnaires on childhood trauma, psychiatric symptoms, and risky behavior engagement. Depression severity was associated with greater odds being a suicide ideator ($p < 0.001$, $OR = 1.04$) and an attempter ($p < 0.001$, $OR = 1.05$) compared to a non-ideator. Suicide attempters used more NSSI methods and reported greater risky behavior engagement than non-ideators ($p = 0.03$, $OR = 1.29$ and $p = 0.03$, $OR = 1.06$, respectively) and

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Contributors

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Catherine R. Glenn: final revision of the manuscript. Stephen E. Gilman: final revision of the manuscript. Joseph Gold: final revision of the manuscript.

Randy P. Auerbach: study design and final revision of the manuscript.

All authors have approved the final version of the article.

Conflicts of interest

The authors declare no conflicts of interest.

ideators ($p = 0.015$, $OR = 1.25$ and $p = 0.04$, $OR = 1.05$, respectively); attempters used more severe NSSI methods (e.g., burning). Our results identify a wide range of risk markers for increasing lethality in a sample at high risk for suicide mortality; future research is needed to refine risk assessments for adolescent self-injurers and determine the clinical utility of using risk markers for screening and intervention.

Keywords

Adolescence; Non-suicidal self-injury; Suicide attempts; Suicide ideation; Risky behavior engagement; Inpatients

Adolescent non-suicidal self-injury (NSSI) and suicidality are serious public health concerns. NSSI—the intentional destruction of one's body tissue with no intent to die (e.g., cutting, burning)—is common among adolescents. The prevalence of adolescent NSSI is approximately 10% and 35% in community and psychiatric samples, respectively (Grandclerc et al., 2016). By contrast, suicide ideation—thoughts of killing oneself—and suicide attempts—self-injurious acts with intent to die—explicitly involve a desire to end one's life. Although suicidality is less prevalent than NSSI, 12.1% of youth report ideation and 4.1% make at least one attempt prior to the age of 18 (Nock et al., 2013). Adolescence is a critical developmental window to investigate both non-suicidal and suicidal thoughts and behaviors, as rates of NSSI and suicidality rise from late childhood to early adolescence, peak in mid-to late-adolescence, and plateau or reduce in young adulthood (Grandclerc et al., 2016).

NSSI and suicide are operationally distinct behaviors that can be differentiated in terms of intention, lethality, and frequency (Guertin et al., 2001); nonetheless, they frequently co-occur. Rates of suicide ideation among adolescent self-injurers are at least double that of non-injurers (Brausch and Gutierrez, 2010). Further, 20% of community adolescent self-injurers and 70% of inpatients reporting NSSI make a lifetime suicide attempt (Brausch and Gutierrez, 2010; Nock et al., 2006). For most, NSSI develops earlier than suicidality and predicts increases in both ideation and attempts over time (Asarnow et al., 2011; Grandclerc et al., 2016). However, factors that might contribute to the transition from NSSI to suicidality are unclear. The present study tests demographic, child maltreatment, and clinical differences among three groups of adolescent self-injurers—non-ideators, suicide ideators, and suicide attempters—which may improve identification of adolescents most likely to transition from NSSI to suicide.

1. NSSI and suicide ideation

Despite elevated rates of suicide ideation among self-injurers, few studies have examined factors that predict ideation. More frequent NSSI behavior has been linked to recurrent and severe suicidal ideation (Paul et al., 2015). However, adolescents rarely (less than 5% of the time) report ideation when they have self-injurious thoughts (Nock et al., 2009a), and NSSI frequency may not directly correspond to increases in suicidal thinking. Alternatively, the most common function of NSSI among adolescents is to escape aversive emotional (sadness, anxiety) or cognitive (negative thoughts or memories) states (Nock et al., 2009b).

Adolescents often use NSSI to reduce negative affect and cognitions, and for some, suicide ideation may develop when NSSI is unsuccessful in mitigating these states. Indeed, compared to adolescents with suicide ideation only, adolescents with NSSI plus ideation report more severe symptomatology (Scott et al., 2015). Further, in a study of NSSI functions among youth, using NSSI to avert suicide was most strongly associated with suicide ideation (Victor et al., 2015). To build upon findings, we examined a more comprehensive set of demographic, child maltreatment, and psychiatric characteristics to determine which factor was most strongly linked to suicide ideation among adolescent self-injurers.

2. NSSI and suicide attempts

According to the interpersonal theory of suicide (ITS; Joiner, 2005), NSSI may build suicide *capability* by habituating the self-injurer to the pain and fear involved in suicide attempts. Consistent with this theory, correlational studies have found that suicide attempts are associated with several indicators of NSSI severity. NSSI frequency is concurrently associated with the number of previous suicide attempts (Andover and Gibb, 2010; Paul et al., 2015) and predicts future attempts (Whitlock et al., 2013). Others have operationalized NSSI severity based on the methods employed (Lloyd-Richardson et al., 2007; Nock et al., 2006). In these studies, attempts are associated with using more NSSI methods overall and using “severe” (e.g., cutting; burning) versus “minor” (e.g., hitting self; pulling hair) methods.

Research also has tested factors that differentiate adolescents who engage in NSSI alone compared to youth reporting NSSI and suicide attempts (Asarnow et al., 2011; Brausch and Gutierrez, 2010; Dougherty et al., 2009; Jacobson et al., 2008; Lloyd-Richardson et al., 2007; Muehlenkamp et al., 2011; Muehlenkamp and Gutierrez, 2007) or adolescents with suicide attempts alone (Csorba et al., 2009; Guertin et al., 2001; Larsson and Sund, 2008). These studies show that adolescents with both NSSI and attempts have: (a) higher rates of psychiatric disorders, particularly major depression and post-traumatic stress disorder (PTSD), (b) greater symptom severity (e.g., suicide ideation, depression, hopelessness), and (c) greater impulsivity. Further, family dysfunction and child maltreatment are more common among adolescents reporting NSSI and suicide attempts. While these studies provide insight about mechanisms implicated in suicidality among self-injurers, these factors were often tested in isolation. As many of these indicators are moderately-to-strongly correlated, it may limit our ability to identify unique risk factors that contribute to suicidal behaviors.

3. Limitations of previous research

Collectively, prior research shows evidence that child maltreatment, psychiatric features, and NSSI-related characteristics may relate to suicide ideation and attempts among self-injurers. However, this work is marked by two important limitations. First, few studies have simultaneously tested multiple risk factors for suicidality among self-injurers; this is problematic because putative predictors of suicidality are often highly correlated. To address this gap, studies must assess a range of risk factors and use multivariate models to determine

which variables confer the greatest risk for suicidality among self-injurers. Second, few previous studies have focused on the overlap of NSSI and suicide ideation, independent of attempts. Research on risk factors for suicidality, in general, has found that strong correlates of suicide ideation are not always associated with attempts (May and Klonsky, 2016). Therefore, it is important to consider different forms of suicidality separately. Addressing these limitations will provide insight into mechanisms through which adolescent NSSI may lead to suicidal behavior.

4. Present study

To improve clinical insight and care among high-risk adolescents, identifying reliable markers of suicide risk among self-injurers is paramount. The goal of this study is to test whether a broad set of demographic, child maltreatment, and psychiatric factors differentiate adolescent self-injurers with: (a) no current suicide ideation and no lifetime suicide attempts (non-ideators), (b) current ideation but no lifetime attempts (ideators), and (c) current ideation and at least one lifetime attempt (attempters). First, based on the few studies testing factors that differentiate self-injurers with and without suicide ideation, depression symptom severity will be significantly greater in both suicide ideators and attempters compared to non-ideators. Further, drawing from research on risk factors for suicidality (May and Klonsky, 2016), we hypothesize that female gender, anxiety (particularly PTSD), and substance use disorders also will be more pronounced among ideators and attempters compared to non-ideators. Second, in line with the ITS, we hypothesized that factors linked to painful and provocative experiences would characterize attempters, specifically. Therefore, we predicted that attempters would have more severe NSSI (i.e., greater frequency and number of methods), higher rates of PTSD, and greater risky behavior engagement. In addition, consistent with previous adolescent research, we expected that greater depression and anhedonia severity, as well as suicide ideation frequency, would differentiate the attempters from the ideators and non-ideators.

5. Methods

5.1. Participants

Participants were 397 adolescents (317 female), aged 13–18 years ($M = 15.44$, $SD = 1.36$) and predominantly White ($n = 322$, 81.11%), recruited from an acute residential treatment program. Patients are admitted to this program for acute clinical concerns (e.g., escalating self-injury), failure to thrive in outpatient treatment, and safety concerns (e.g., suicidal behaviors). All participants reported at least one lifetime NSSI episode (i.e., answered “yes” to the question “Have you ever actually purposely hurt yourself without wanting to die?”), assessed by the Self-Injurious Thoughts and Behaviors Interview (SITBI; Nock et al., 2007). The majority ($n = 347$, 87.4%) of adolescents engaged in NSSI in the past year, most in the past month ($n = 298$, 75.1%) and one-third in the week prior to hospitalization ($n = 133$, 33.5%).

Demographic and clinical characteristics are summarized in Table 1. The SITBI and Beck's Scale for Suicide Ideation (BSS; Beck et al., 1979) were used to classify adolescents as: (a) non-ideators ($n = 96$), if there was no current suicide ideation (i.e., BSS = 0; Holi et al.,

2005) and no past history of suicide attempts, (b) suicide ideators ($n = 149$), if there was current ideation (i.e., BSS ≥ 4 ; Holi et al., 2005) and no history of attempts, or (c) suicide attempters ($n = 152$), if there was both current suicide ideation and at least one lifetime suicide attempt (i.e., answering “yes” to the SITBI item “Have you ever made an actual attempt to kill yourself in which you had at least some intent to die?”). Seventy-eight (51.3%) attempters reported multiple lifetime attempts. The majority ($n = 127$, 83.6%) reported at least one past year attempt and nearly half had made an attempt in the past month ($n = 72$, 47.4%).

The sample was drawn from a larger group of 451 adolescents hospitalized between November 2013 and November 2015. Among these adolescents, 48 (10.6%) had a history of suicide attempts but did not meet the suicide ideation cut-off and 6 (1.3%) were missing suicide ideation scores. Compared to excluded adolescents, included participants were more likely to have Social Phobia, $\chi^2(1, N = 451) = 7.84$, $\Phi = 0.13$, and report more severe depression, $t(446) = 2.23$, $p = 0.03$, $d = 0.21$. Included and excluded adolescents did not differ on any other demographic or clinical variables (all $ps > 0.08$).

5.2. Procedure

The Institutional Review Board approved this study and data collection took place within the context of a quality assurance program. Parents and 18-year-old adolescents provided written consent; youth under 18 provided assent. Assessments were conducted by graduate students and BA-level research assistants who received a minimum of 25 h of training (e.g., mock-interviews, case conferences). Adolescents completed clinical interviews regarding psychiatric diagnoses, NSSI, and suicidality, as well as questionnaires on childhood trauma, psychiatric symptoms, and risky behavior engagement.

5.3. Measures

5.3.1. MINI-KID (Sheehan et al., 2010)—The MINI-KID is a structured diagnostic interview that assesses current psychopathology and certain lifetime disorders in youth. It has strong psychometric properties and is concordant with gold-standard interviews (Sheehan et al., 2010).

5.3.2. SITBI (Nock et al., 2007)—The SITBI is a structured clinical interview that assesses the presence, frequency, and severity of suicidal and NSSI thoughts and behaviors that has been validated in adolescent inpatients. We used the age of NSSI onset (“How old were you the first time you purposely hurt yourself without wanting to die?”), the number of NSSI methods used, and the frequency of NSSI behaviors in the past month as predictors in our primary models. We also used lifetime suicide attempts, past month suicide ideation (“How many days in the past month have you had thoughts of killing yourself?”), and past month suicide plans (“How many days in the past month have you made a plan to kill yourself?”) in primary models.

5.3.3. BSS (Beck et al., 1979)—The BSS is a 19-item self-report questionnaire assessing past week ideation. Each item is scored from 0 (*least severe*) to 2 (*most severe*), with total

scores ranging from 0 to 38. Higher scores indicate more severe suicidal ideation. BSS items had excellent reliability in our adolescent sample ($\alpha = 0.92$).

5.3.4. Childhood trauma questionnaire (CTQ; Bernstein and Fink, 1998)—The CTQ is a 25-item questionnaire that assesses childhood experiences of abuse and neglect. We focused on the 5-item physical and sexual abuse subscales of the measure. Each item is rated on a 5-point scale (1 = *never true* to 5 = *very often true*), yielding total subscale scores that range from 5 to 25 (higher scores reflect more severe abuse). Following the CTQ guidelines, subscale scores were dichotomized into the presence/absence of physical (scores ≥ 8) and sexual (scores ≥ 6) abuse.

5.3.5. Center for epidemiologic studies depression scale (CES-D; Radloff, 1977)—The CES-D is a 20-item self-report inventory assessing depression symptom severity in the past week. Each item is rated on a scale from 0 (*rarely or none of the time*) to 3 (*almost or all of the time*), and scores range from 0 to 60, with higher scores indicating more severe depression. The internal consistency of the CES-D was excellent in our sample ($\alpha = 0.95$).

5.3.6. Multidimensional anxiety scale for children (MASC; March et al., 1997)—The MASC is a 39-item self-report questionnaire assessing current anxiety symptoms. Items were rated from 0 (*Never true about me*) to 3 (*Often true about me*), with total scores ranging from 0 to 117. Higher total MASC scores indicate more severe anxiety symptoms. MASC items demonstrated excellent reliability in our sample ($\alpha = 0.92$).

5.3.7. Snaith–hamilton pleasure scale (SHAPS; Snaith et al., 1995)—The SHAPS is a 14-item self-report inventory assessing respondents' ability to experience pleasure. Items are rated from 1 (*strongly disagree*) to 4 (*strongly agree*). Total scores ranged from 14 to 56 with higher scores indicating more severe anhedonia. In our sample, the SHAPS had excellent internal consistency ($\alpha = 0.93$).

5.3.8. Risky behavior questionnaire for adolescents (RBQ-A; Auerbach and Gardiner, 2012)—The RBQ-A is a 20-item questionnaire that assesses the frequency of risky behaviors (e.g., sexual precociousness, aggression, rule-breaking) in the past month. Each item ranges from 0 (*never*) to 4 (*always: 4 or more times per week*). We removed one item ("Have you made attempts to cut or burn yourself?") to avoid overlap between the RBQ-A and SITBI. Thus, total scores ranged from 0 to 76, and higher scores indicated greater risky behavior engagement. The internal consistency of the RBQ-A items was acceptable ($\alpha = 0.78$). The RBQ-A also includes the following subscales: Aggression (5 items), Risky Sexual Behavior (2 items), Substance Use (4 items), Rule-breaking (3 items) and Illegal Behavior (4 items).

5.4. Data analytic overview

We first conducted a series of univariate analyses to identify demographic and clinical factors that differentiated our groups. For nominal variables we used chi-square analyses and for continuous measures we used one-way analysis of variance (ANOVA) models. For count

variables, we used Poisson regression models with robust standard errors to manage expected overdispersion. For all analyses, we conducted follow-up, Bonferroni-corrected (critical $p < 0.017$) pairwise comparisons testing group differences. All measures that differentiated our groups were entered as independent variables in an omnibus multinomial logistic regression analysis predicting group membership. To control for over-dispersion in the multinomial regression model, standard errors were adjusted from the Pearson chi-square.

6. Results

6.1. Univariate analyses

Table 1 summarizes univariate analyses testing differences among non-ideators, ideators, and attempters. None of the demographic variables differentiated the groups. With regards to child maltreatment, rates of physical abuse significantly differed across groups, with attempters reporting more physical abuse than non-ideators. For psychiatric indices, ideators and attempters showed higher rates of unipolar mood disorders and social phobia. Being an ideator or attempter, versus a non-ideator, was associated with a higher number of disorders. Further, ideators and attempters reported more severe depression and anxiety symptoms than non-ideators. Unexpectedly, attempters and non-ideators had higher rates of psychotic symptoms compared to suicide ideators, and attempters were more likely to have a substance use disorder than ideators. In terms of NSSI and suicidality variables, being an attempter, compared to being a non-ideator or ideator, was associated with a greater number of NSSI methods and more frequent past month risky behavior engagement. Finally, attempters reported first engaging in NSSI at a significantly younger age than both non-ideators and ideators.

In light of findings indicating that adolescent multiple lifetime suicide attempters are at greater risk for future attempts compared to ideators or single attempters (Miranda et al., 2008), we conducted exploratory univariate analyses testing differences between single and multiple attempters. None of the demographic variables differentiated the two groups ($ps > 0.27$). Neither rates of physical abuse, $\chi^2(1, N = 141) = 0.27, p = 0.60, \Phi = 0.04$, nor sexual abuse, $\chi^2(1, N = 140) = 1.19, p = 0.28, F = 0.09$, differentiated single and multiple attempters. Further, rates of specific diagnoses did not differ between groups (all $ps > 0.08$, all $\Phi_s < 0.15$) and single and multiple attempters endorsed a similar number of psychiatric diagnoses, Wald $\chi^2(1, N = 145) = 1.17, p = 0.28$. Finally, single and multiple attempters did not differ in the frequency of their past month suicide ideation, plans, or NSSI (Wald $\chi^2_s < 2.93, ps > 0.08$), number of NSSI methods employed, $\chi^2(1, N = 145) = 0.06, p = 0.80$, or NSSI age of onset, $t(143) = 1.52, p = 0.13, d = 0.26$.

6.2. Multivariate analyses

The omnibus multinomial regression analysis included the following variables: the presence/absence of a unipolar mood disorder, social phobia, a substance use disorder, and psychotic symptoms; comorbidity; the presence/absence of physical abuse; the frequency of past month suicide ideation and plans; the number of NSSI methods; age of onset of NSSI behaviors; depression and anxiety symptoms; and risky behavior engagement. The model

was significant, $R_{C\&S} = 0.35$, $\chi^2(26, N = 381) = 164.43$, $p < 0.001$, and unique effects of all predictors are presented in Table 2. Ideators had significantly lower rates of psychotic symptoms compared to non-ideators ($OR = 0.08$) and attempters had significantly higher rates of psychotic symptoms than ideators ($OR = 5.84$). Ideators and attempters (who did not differ) reported more severe depression symptoms than non-ideators. Compared to both non-ideators ($p = 0.03$) and ideators ($p = 0.015$), who did not differ, attempters reported using more NSSI methods, although the former effect was at a statistical trend. Similarly, attempters reported greater risky behavior engagement than ideators ($p = 0.03$) and non-ideators ($p = 0.04$); both effects were at a trend level.

6.3. Exploratory analyses: effects of specific NSSI methods and risky behaviors

Previous research suggests that certain types of NSSI behaviors (e.g., cutting) may be more strongly associated with suicidality. Victor and Klonsky (2014) proposed that methods associated with more pronounced tissue damage might be particularly associated with greater capability for suicidal behavior. We therefore conducted post-hoc chi-square analyses for each specific type of NSSI and significant omnibus results were probed with pairwise analyses (critical alpha: $p < 0.017$). Compared to non-ideators and ideators, attempters were more likely to have burned and scraped their skin. Both skin picking and hitting oneself were more common among ideators and attempters compared to non-ideators (see Table 3).

Prior work also suggests that certain risky behaviors may be more strongly tied to suicidality than others. For example, aggression may play a critical role in adult suicide attempts (Mann et al., 1999). We used post-hoc univariate ANOVAs to test group differences in each domain of risky behavior. Attempters had higher Aggression scores than both non-ideators and ideators, who did not differ (see Table 3). For Risky Sexual Behavior and Substance Use, attempters had higher scores than ideators, but not non-ideators, and for Rule-breaking, attempters had higher scores than non-ideators, but not ideators. Last, attempters reported more frequent past month Illegal Behavior than ideators and non-ideators at a trend level ($p = 0.02$).

7. Discussion

Adolescent self-injury increases risk for future suicidality and thus, identifying reliable markers associated with suicidality among self-injurers is critical for improving clinical care. Using a large, representative sample of adolescent self-injurers, we tested whether a broad range of demographic, child maltreatment, and clinical factors differentiated three groups: non-ideators, ideators, and attempters. Three findings emerged. First, compared to non-ideators, suicidal self-injurers (ideators and attempters) had more severe depression. Second, attempters used more NSSI methods and engaged in more risky behavior compared to non-attempters (non-ideators and ideators). Last, exploratory, post-hoc analyses revealed that attempters had higher rates of burning and skin scraping, as well as greater aggressive behavior, than non-attempters.

7.1. Differentiating non-ideating self-injurers from suicidal self-injurers

Previous research has found that depression symptoms are more severe among ideators compared to non-suicidal adolescents (May and Klonsky, 2016; Nock et al., 2013) and is moderately associated with suicide attempts among self-injurers (Victor and Klonsky, 2014). Consistent with these findings, ideators and attempters had more severe depression than non-ideators. Adolescents most often report using NSSI to reduce aversive emotional states (Nock et al., 2009a,b). For non-ideators, NSSI may effectively diminish negative affect and distress, which results in less depression and consequently, lower suicidality. Yet, NSSI may not be effective for suicidal self-injurers, and thus, may compound distress and increase suicidality. Additionally, depression is heterogeneous and some symptoms—namely hopelessness and helplessness—are more closely associated with suicide ideation than others (May and Klonsky, 2016). Therefore, there may be other factors (e.g., low social support) linked to the composition of depression symptoms that could explain elevations in ideation among certain self-injurers.

In community samples, psychotic symptoms confer risk for ideation and are associated with a 3-fold greater likelihood of suicide attempts (Honings et al., 2016). In contrast, we found that rates of psychotic symptoms were higher among non-ideators and attempters, who did not differ, compared to suicide ideators. These partially inconsistent findings should be considered in light of the low rate of psychosis in the sample overall; replication in samples wherein psychosis is more prevalent is needed. Further, although psychotic experiences are linked to future NSSI behavior among adolescents (Martin et al., 2015), data on how psychosis contributes to suicidality in self-injurers is lacking. This may be because studies on adolescent suicidality often exclude patients with psychosis.

7.2. Differentiating attempters from non-attempters

Depression robustly differentiated non-suicidal and suicidal self-injurers, but ideators and attempters did not differ in these symptoms. These results are consistent with epidemiological data showing that depressive disorders are strongly associated with suicide ideation, but are weakly associated with attempts among ideators (Nock et al., 2009a,b, 2013). In contrast, adolescent self-injurers who had made an attempt reported using more NSSI methods, but not more frequent NSSI, and greater risky behaviors (e.g., substance use, aggression). These findings contribute to mounting evidence that the number of different self-destructive behaviors adolescents use provides important clinical information about suicide risk. For example, rates of attempted suicide are higher among poly-substance users compared to single substance users (Landheim et al., 2006) and a greater number of purging methods is linked to suicidality among eating disorder patients (Stein et al., 2004). Further, among adult (Turner et al., 2013) and adolescent (Nock et al., 2006) self-injurers, the number of NSSI methods used—and not NSSI frequency—predicts suicide attempts. Our results extend prior findings in two ways. First, they show that the number of NSSI methods adolescents use may be specifically related to suicide attempts and not ideation. Second, although NSSI and general risk-taking behavior overlap considerably, our results show they are each distinctly linked with adolescent suicide attempts.

Previous research provides insight into why a broad range of self-destructive behaviors may enhance suicide risk among self-injurers. Consistent with the ITS (Joiner, 2005), adults who report more painful and provocative events (i.e., broad risky behaviors) have greater pain tolerance and fearlessness of death (Bender et al., 2011), two elements implicated in suicide capacity, and score higher on measures of acquired suicide capability (Van Orden et al., 2008). Thus, diverse self-destructive behaviors may allow adolescents to habituate to a range of painful experiences, leaving them more prepared to enact potentially lethal self-harm. Alternatively, engaging in a number of self-destructive behaviors may mark heightened distress and/or coping deficits. When one form of maladaptive coping (e.g., cutting) is ineffective, self-injuring adolescents may shift to other strategies (e.g., aggression) to reduce their distress. The failure of multiple self-destructive behaviors to regulate negative affect may ultimately culminate in suicidal behavior. A final possibility is that the self-destructive behaviors measured in the present study are markers of underlying traits (e.g., impulsivity) we did not measure and that are related to suicide risk. Future research should formally test these competing explanations and elucidate why engagement in diverse self-destructive behavior is linked to suicide attempts in self-injurers.

7.3. Exploratory analyses: specific NSSI methods and risky behaviors

Presently, the boundary between non-suicidal and suicidal behaviors is not always clear, and misclassifying these behaviors may be costly in clinical settings. The distinction between non-suicidal and suicidal behavior rests on intent to die, which is not directly observable. This makes self-injurious behaviors difficult to assess and classify. Our analyses show that specific self-destructive behaviors—burning, skin scraping, and aggression—might be useful indicators of risk for suicidal behavior in adolescent self-injurers. These findings require replication, however, as they are inconsistent with findings showing that cutting/carving is most strongly tied to attempts (Victor and Klonsky, 2014). This caveat aside, our results underscore the utility of measuring specific self-destructive behaviors to improve assessments of suicide risk, which may optimize decision-making in clinical care for high-risk youth.

7.4. Future directions

Rates of NSSI and suicidality increase from childhood to adolescence and peak in prevalence between 15 and 19 years old (Grandclerc et al., 2016). Incidences of major depression (Avenevoli et al., 2015) and risky behavior engagement (Kann et al., 2014) also comparably increase in adolescence. To better understand how NSSI leads to suicidal ideation and attempts or vice versa, research must focus on risk factors that come online in early adolescence and test time-dependent associations between these factors, NSSI, and suicidality. This not only will improve fundamental knowledge of the developmental origins of NSSI and suicidality but also will produce viable inroads for prevention and early intervention.

Our findings suggest that assessment of neurocognitive mechanisms may provide further insight into suicide risk among self-injurers. For instance, trait impulsivity—particularly reflexive behavioral reactivity to emotions—is associated with NSSI (Glenn and Klonsky, 2010) and suicide attempts (Auerbach et al., in press) and adolescents with NSSI and

previous attempts show greater delay-discounting than those with NSSI only (Dougherty et al., 2009). Normative increases in risk-taking and impulsivity during adolescence are thought to arise from increased maturation of limbic circuitry, responsible for heightened emotional reactivity, relative to under-developed prefrontal regions, responsible for inhibition and impulse control (Casey et al., 2008). Therefore, an important direction for future research is to examine dysfunction in prefrontal cognitive control regions as an early vulnerability marker of NSSI and suicidality.

A final future direction is to test the generalizability of our findings to community samples of adolescents. Some of the effects we found in our high-risk inpatients were consistent with research on youth from the general population. For instance, risky behaviors like aggression, drug and cigarette use, and unprotected sex differentiate community adolescent ideators from attempters, while depression has far weaker effects (Liu et al., 2014; Stack, 2014; Taliaferro and Muehlenkamp, 2014). However, anxiety disorders (particularly PTSD) and impulse-control disorders (e.g., conduct disorder, intermittent explosive disorder) are consistently linked to suicide attempts among ideators in community samples (e.g., Miranda et al., 2008; Nock et al., 2009a,b, 2013), but these disorders were non-significant in our models. Similarly, rates of sexual abuse are higher among attempters compared to ideators (Brezo et al., 2007; May and Klonsky, 2016; Taliaferro and Muehlenkamp, 2014) in community samples, but we did not find this effect. One reason for these discrepancies is that rates of psychiatric disorders and maltreatment are far higher in inpatient versus community adolescents, potentially limiting their power to discriminate between ideators and attempters. Relatedly, our sample was entirely self-injurers, which raises the possibility that factors most strongly linked to attempts among non-injurers (i.e., the majority of community adolescents) may not be as important for adolescent self-injurers. Additional large-scale studies of factors that differentiate ideators and attempters among non-hospitalized self-injurers are warranted to address these possibilities.

7.5. Limitations

Our findings should be considered in light of the following central limitations. First, data were cross-sectional, between group comparisons and we cannot confirm a causal relationship between clinical factors and adolescent suicidality. A critical next step is to test longitudinal predictors of first onsets of ideation and attempts within self-injurers during early- and middle-adolescence. Second, our pattern of univariate findings raises the possibility that non-ideators may have been less clinically severe overall, rather than differing from ideators and attempters on specific characteristics. Last, although we examined a broad set of factors, we did not include some variables (e.g., hopelessness, borderline personality disorder symptoms) that may be strongly linked to suicidality among adolescent self-injurers.

8. Conclusions

The present study tested a wide range of potential correlates of suicide ideation and attempts in adolescent inpatient self-injurers. Depression differentiated non-ideating self-injurers from suicidal self-injurers, but only NSSI methods and risky behavior engagement were

associated with attempts. Research must move beyond psychiatric diagnoses and symptoms to develop a more fine-grained set of markers of suicide, particularly among adolescent self-injurers. This may refine risk assessment and improve delivery of appropriate interventions, thereby limiting preventable loss of life.

Acknowledgments

The authors gratefully acknowledge the clinicians and staff of the McLean Academic Center for their support with study recruitment. The authors thank Ms. Judy Kim for her role in participant recruitment and database management.

Role of the funding source

This study was partially supported through funding from the NIMH (K23MH097786), the Klingenstein Third Generation Foundation Adolescent Depression Fellowship, the Tommy Fuss Fund, the Rolfe Fund, and the Simches Fund awarded to Randy P. Auerbach.

Further support was provided by the Pope-Hintz Endowed Fellowship, awarded by McLean Hospital to Jeremy G. Stewart.

Finally, the Intramural Research Program of the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development supported Stephen E. Gilman.

The funding sources listed above had no involvement in study design, data collection, analysis and interpretation, writing the manuscript, or the decision to submit the article for publication.

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Table 1

Descriptive statistics stratified by non-ideators, suicide ideators and suicide attempters.

	Descriptive statistics (<i>M (SD)</i> or <i>n (%)</i>)			<i>F/χ²</i>	<i>p</i>	Φ / η_p^2
	Non-ideators	Ideators	Attempters			
Demographics						
Age	15.60 (1.38)	15.50 (1.30)	15.26 (1.39)	2.17	0.12	
Sex (female)	75 (78.12)	118 (79.73)	124 (83.78)	1.40	0.50	0.06
Race (White)				5.24	0.73	0.12
White	77 (80.21)	121 (83.45)	124 (82.67)			
Black	2 (2.08)	2 (1.38)	3 (2.00)			
Asian	4 (4.17)	10 (6.90)	7 (4.67)			
Native American	2 (2.08)	0 (0.00)	1 (0.67)			
2 or more races	11 (11.46)	12 (8.28)	15 (10.00)			
Child maltreatment						
Physical abuse	10 (10.42) ^a	23 (15.65) ^{a,b}	39 (26.35) ^b	11.04	<0.01	0.17
Sexual abuse	25 (26.32)	40 (26.85)	55 (37.41)	5.02	0.08	0.11
Psychiatric indices						
Any unipolar mood	71 (73.96) ^a	135 (90.60) ^b	140 (92.11) ^b	19.84	<0.001	0.22
Any bipolar mood	7 (7.29)	8 (5.37)	9 (5.92)	0.39	0.82	0.03
Panic disorder	25 (26.04)	47 (31.54)	49 (32.24)	1.19	0.55	0.06
Separation anxiety	6 (6.25)	6 (4.0)	4 (2.63)	1.99	0.37	0.07
Social phobia	25 (26.04) ^a	62 (41.61) ^b	75 (47.37) ^b	11.39	<0.01	0.17
Specific phobia	4 (4.17)	6 (4.03)	10 (6.58)	1.23	0.54	0.06
OCD	5 (5.21)	15 (10.07)	12 (7.89)	1.87	0.39	0.07
GAD	33 (34.38)	57 (38.26)	57 (37.50)	0.40	0.82	0.03
PTSD	15 (15.63) ^a	28 (18.79) ^a	43 (28.29) ^a	6.72	0.04	0.13
Any alcohol use	2 (2.08)	2 (1.34)	9 (5.92)	5.55	0.06	0.12
Any substance use	7 (7.29) ^{a,b}	4 (2.68) ^a	15 (9.87) ^b	6.46	0.04	0.13
ADHD	19 (19.79)	34 (22.82)	31 (20.39)	0.41	0.82	0.03
Any eating disorder	4 (4.17)	8 (5.37)	14 (9.21)	2.99	0.22	0.09
Psychotic symptoms	14 (14.58) ^b	6 (4.03) ^a	20 (13.16) ^b	9.76	<0.01	0.16
# of Disorders ^a	2.25 (1.56) ^a	2.76 (1.41) ^b	3.11 (1.63) ^b	13.57	<0.01	
Depression symptoms	19.91 (14.64) ^a	32.37 (13.09) ^b	32.20 (14.65) ^b	30.56	<0.001	0.13
Anxiety symptoms	55.58 (19.99) ^a	65.48 (16.80) ^b	65.61 (16.87) ^b	11.61	<0.001	0.06
Anhedonia	37.17 (10.76)	35.18 (7.49)	36.60 (7.29)	1.93	0.15	0.01
Risky behaviors	6.77 (5.42) ^a	6.39 (5.39) ^a	9.83 (7.96) ^b	11.95	<0.001	0.06
NSSI & Suicidality ^a						
Ideation, past month	5.21 (7.80) ^a	14.60 (10.25) ^b	14.78 (9.93) ^b	43.93	<0.001	

	Descriptive statistics (<i>M</i> (<i>SD</i>) or <i>n</i> (%))			<i>F</i> / χ^2	<i>p</i>	Φ / η_p^2
	Non-ideators	Ideators	Attempters			
Plans, Past Month	0.70 (2.39) ^a	3.53 (6.23) ^b	5.30 (8.33) ^b	30.77	<0.001	
NSSI, Past Month	5.89 (15.62)	6.25 (11.59)	9.58 (16.47)	4.83	0.09	
# NSSI Methods	2.59 (1.60) ^a	2.75 (1.45) ^a	3.69 (1.65) ^b	37.24	<0.001	
Age of Onset NSSI	13.27 (1.92) ^a	13.41 (2.21) ^a	12.51 (2.44) ^b	6.78	<0.01	

Note. OCD = Obsessive-Compulsive Disorder; GAD = Generalized Anxiety Disorder; PTSD = Post-Traumatic Stress Disorder; ADHD = Attention Deficit Hyperactivity Disorder; NSSI = Non-suicidal self-injury. Values with different superscripts significantly differ (Bonferonni Correction: $p < 0.017$). Rows of values with the same superscript indicate that the omnibus effect was significant, but all follow-up pairwise comparisons were non-significant.

^aGroup differences were tested in Poisson regression analyses with robust standard errors. Group (non-ideator, ideator, non-attempter) was entered as a categorical predictor variable in these analyses. Count variables have a separate effect size (odds ratio) for each of the 3 pairwise comparisons; therefore, effect sizes for these variables were not included.

Table 2

Results from omnibus multinomial regression analysis predicting suicidality status (non-ideator, suicide ideator, suicide attempter) from clinical characteristics of the sample.

	<u>Total</u>	<u>Ideators vs. Non-Ideators^a</u>		<u>Attempters vs. Non-Ideators^a</u>		<u>Attempters vs. Ideators^a</u>	
	χ^2	OR	CI ₉₅	OR	CI ₉₅	OR	CI ₉₅
Any unipolar mood	1.01	0.98	0.40–2.39	1.50	0.58–3.84	1.52	0.61–3.80
Social phobia	0.14	0.95	0.42–2.16	1.07	0.47–2.46	1.13	0.59–2.18
Any substance use	2.06	0.33	0.07–1.62	0.64	0.16–2.52	1.96	0.51–7.45
Psychotic symptoms	16.48 ^{***}	0.08 ^{***}	0.02–0.33	0.46	0.16–1.29	5.84 ^{***}	1.57–21.74
Physical abuse	1.23	1.26	0.46–3.43	1.63	0.63–4.23	1.30	0.64–2.63
# of disorders	0.28	0.97	0.72–1.30	0.93	0.69–1.25	0.96	0.76–1.22
Ideation, past month	17.27 ^{***}	1.09 ^{***}	1.04–1.14	1.07 ^{**}	1.02–1.12	0.98	0.95–1.01
Plans, past month	6.96 [*]	1.10	0.96–1.26	1.14 [^]	0.99–1.31	1.04 [^]	1.00–1.08
# NSSI methods	7.85 [*]	1.03	0.82–1.29	1.29 [*]	1.03–1.62	1.25 ^{**}	1.04–1.50
Age of Onset NSSI	2.92	1.08	0.92–1.26	0.97	0.83–1.14	0.90	0.80–1.02
Depression symptoms	14.90 ^{***}	1.04 ^{***}	1.02–1.07	1.05 ^{***}	1.02–1.07	1.00	0.98–1.02
Anxiety symptoms	0.73	1.01	0.99–1.03	1.00	0.98–1.03	0.99	0.97–1.01
Risky behaviors	7.10 [*]	1.01	0.95–1.07	1.06 [*]	1.01–1.12	1.05 [*]	1.01–1.11

Note.

[^]
 $p < 0.08$

^{*}
 $p < 0.05$

^{**}
 $p < 0.017$

^{***}
 $p < 0.001$.

^aDenotes the comparison group; NSSI = Non-suicidal self-injury.

Table 3

Analyses testing group differences among non-ideators, ideators and attempters across specific methods of non-suicidal self-injury and domains of risky behavior engagement.

	<u>Descriptive statistics (<i>M</i> (<i>SD</i>) or <i>n</i> (%))</u>			<i>F</i> / χ^2	<i>p</i>	Φ / η_p^2
	Non-ideators	Ideators	Attempters			
NSSI Method						
Cut/Carve skin	87 (90.63)	138 (92.62)	146 (96.05)	3.10	0.21	0.09
Burn skin	24 (25.00) ^a	33 (22.15) ^a	67 (44.08) ^b	19.14	<0.001	0.22
Insert sharp object	23 (24.96)	41 (27.52)	52 (34.21)	3.33	0.19	0.09
Picked body	34 (35.42) ^a	59 (39.60) ^{a, b}	79 (51.97) ^b	7.92	0.02	0.14
Hit self	37 (38.54) ^a	63 (42.28) ^{a, b}	85 (55.92) ^b	8.93	0.01	0.15
Gave self tattoo	3 (3.13)	2 (1.34)	4 (2.63)	0.99	0.61	0.05
Scraped skin	34 (35.42) ^a	58 (38.93) ^a	91 (59.87) ^b	19.09	<0.001	0.22
Risky Behavior Subtype						
Aggression	1.17 (1.72) ^a	1.10 (1.80) ^a	2.04 (2.52) ^b	8.76	<0.001	0.04
Risky Sex	0.34 (0.66) ^{a, b}	0.21 (0.88) ^a	0.51 (1.00) ^b	4.31	0.01	0.02
Substance use	1.65 (2.13) ^{a, b}	1.13 (2.00) ^a	2.11 (3.01) ^b	6.01	<0.01	0.03
Rule-breaking	2.71 (1.93) ^a	2.99 (2.07) ^{a, b}	3.45 (2.16) ^b	3.99	0.02	0.02
Illegal behavior	0.44 (1.04) ^{a, b}	0.37 (0.77) ^a	0.79 (1.45) ^b	5.66	<0.01	0.03

Note. NSSI = Non-Suicidal Self-Injury; Values with different superscripts significantly differ (Bonferonni Correction: $p < 0.017$).